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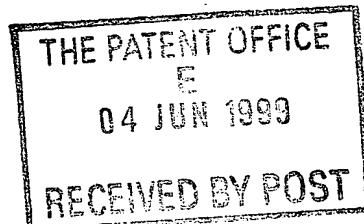
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## Request for grant of a patent

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## 1. Your reference

JTS/P08932GB

## 2. Patent application number

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3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

7673270001

## 4. Title of the invention

Playing Surface Substrate

5. Name of your agent *(if you have one)**"Address for service" in the United Kingdom to which all correspondence should be sent  
(including the postcode)*

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Number of earlier application

Date of filing  
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No

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
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# Patents Form 1/77

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Description 23

Claim(s) -

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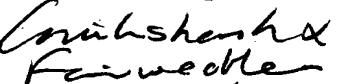
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Jan T Szczuka

- 0131.225.4500

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### Playing Surface Substrate

The present invention relates to a substrate material for use as a playing surface. In particular, the substrate material 5 is for use as a playing surface substrate for practising and/or playing golf.

To facilitate learning or practising the game of golf it is common to use the facilities provided at a golf driving range. 10 Golf driving ranges generally provide practice areas provided with practice mats. Typically, the practice mats are rectangular in shape and are formed arranged to provide a player standing area and at least one or more pre-set locations for placement of golf tees.

15

The practice mats are generally placed on the floor of the driving range, which is typically made from concrete or some other similar substance which is hard and non-resilient. In addition to the foregoing there are also commercially 20 available relatively expensive practice mats. These mats are generally provided on raised support platforms which are formed from a rigid plastic material or wood.

It has been found that repeated playing off on practice areas 25 of the abovementioned types can lead to various repetitive

stress injuries similar to tennis elbow. These injuries are generally caused by the inadvertent striking of the more or less hard non-resilient playing surface of the practice mat/block with the golf-club. The resulting jarring effect is transmitted to the joints (particularly the elbow and shoulder joints) of the player. Repeated jarring of this type has been found to result in injury to the connective tissue in and/or around the affected joints.

10 Practice mats/platforms of this type allow the player to practice and/or learn only a limited range of strokes. Only those strokes which require the golf ball to be resting on a tee or those strokes which do not require the club to strike the underside of the golf ball (for example, when putting back 15 spin onto a golf ball) can be practised. Playing strokes of the type which require the club to strike the underside of the golf ball greatly increases the possibility of the club striking the practice mat, and so increase the likelihood of injury to the player.

20

It is also a particular feature of these practice mats that there is only a limited number of pre-selected locations for placement of tees. This limitation of the restricted number and locations for placement of tees does not suit all of the

many individual playing styles or the different statures of individuals wishing to use the practice mats/platforms.

It is an object of the present invention to avoid or minimise 5 one or more of the foregoing disadvantages.

The present invention is directed towards the provision of a mat suitable for use as a playing surface which is flexible, resilient and can deform more or less like natural turf or 10 grass under the impact of a golf club. The mat is also robust enough to be walked upon without sustaining damage to the mat.

In a first aspect of the present invention, there is provided a mat suitable for use as a playing surface and comprises a 15 honeycomb form support matrix packed with a filler material.

The support matrix may be in the form of a more or less integrally-formed structure or conveniently is in the form of a close packed assembly of substantially upright tubes packed with filler material.

20

The tubes are generally formed from a reasonably flexible and deformable material to facilitate close packing thereof and enable the mat to yield under the impact of for example, a golf club. Suitable materials that may be mentioned include 25 one or more of: plastics film or sheeting which is preferably

biodegradable, paper, cardboard, and textile sheet materials of natural or synthetic fibres which may be woven or non-woven. Furthermore, the material used to fabricate the tubes may be porous or non-porous. It would be particularly 5 desirable to choose a material which is porous to facilitate the movement of moisture (or excess water) into and out of the tubes thereby avoiding for example water-logging of the mat in wet conditions or in the case of over-watering.

10 The tubes are preferably generally cylindrical in shape, however they may be square, rectangle, elliptical or polygonal in section. Typically, the tubes are packed in a hexagonal close packed configuration. Alternatively the tubes are arranged in a less closely packed arrangement such as a square 15 close packed configuration. It will also be appreciated that with tubes of a generally flexible material, the tubes may be deformed to a greater or lesser extent resulting in even closer packing together.

20 Typically, the tubes have a diameter of from 0.5 cm to 10 cm, preferably from 1 cm to 5 cm and most preferably from 1 cm to 3 cm. The tubes typically have a height of from 3 cm to 25 cm, preferably from 5 cm to 15 cm and most preferably from 5 cm to 10 cm. It will of course be realised that these 25 dimensions can be altered and varied according to particular

requirements. Furthermore, it is also envisaged that tubes of different diameters may be present within the mat. In this case the arrangement of the tubes may be regular as above or it may be more random to accommodate the different sizes of 5 tubes more efficiently. The tubes may also be closed at the bottom end portion to provide a tube which is open only at the top portion.

Adjacent tubes in the mat may be bonded or otherwise attached 10 together at one or more shared edges or sides of said adjacent tubes. Preferably the tubes are glued together along the mutually co-operating edges or sides. The bonding of the tubes together has the beneficial effect of providing additional strength and robustness to the mat. Furthermore, 15 bonding the tubes together allows easier handling and placement in use of the mat.

The filler material is generally packed into the tubes sufficiently tightly so that the filler material resists 20 falling out of the tubes when the mat is being manoeuvred or otherwise handled. On the other hand, it is normally desirable to avoid excessively tight packing that could result in compaction of the filler and loss of resilience in the playing surface. Suitable packing conditions may be readily 25 determined by simple trial and error.

Once packed with filler material, the tubes may optionally be sealed to provide a tube which is closed at the top and/or bottom portions. It is particularly desirable to seal the 5 tubes where a material is used which is more prone to falling out of the tubes when the mat is being manoeuvred or otherwise handled. Filler materials with little or no interlocking capacity such as sand, grit, polymer beads or chips and the like are examples of such filler materials.

10

The integrally-formed or close packed assembly structure of the mat allows easy handling by being in the form of a continuous layer of support matrix.

15 The mat of the present invention generally provides a playing surface more representative of natural turf and grass surfaces found on golf courses than the currently available golf practice mats/platforms. The mat has more naturally deformable properties due to the use of the filler material, 20 in addition to reasonable structural stability, in use, (to lateral and vertically applied forces) when a golf club strikes the mat, when a player stands on the mat, and/or for the placement of golf tees.

Furthermore, in use, when a player strikes the mat with a golf club, the mat deforms under the impact of the club in a manner very similar to natural turf or grass surfaces, with a reduced possibility of injury to the player over that of the prior art 5 practice mats/platforms. The abovementioned advantageous properties of the mat allow a player to play a wider range of strokes than is possible with currently available practice mats/platforms.

10 The filler material can be chosen to mimic the properties of a particular golf course or any other desired playing surface. To achieve this, the filler material conveniently comprises at least one of, the following materials: soil such as various types of loam, sphagnum moss, peat, wood chips/shavings, 15 sawdust, clay, sand, polymer chips/beads/fragments, and papier mache. Where a filler material is for example very fibrous it will have a large number of interconnected and/or interwoven fibres which provide a stabilising network within which it is possible to incorporate further non-fibrous or fibrous filler 20 materials. The choice of filler material providing the stabilising network of fibres, may be varied to adjust or modify the density of interconnected and/or interwoven fibres to provide a range of different stabilising effects. For example, where a further filler material such as sand (which 25 has little or no interlocking properties) is used, it may be

necessary to use a filler material with a relatively high content and density of interconnected and/or interwoven fibres to prevent the sand from settling at the bottom of the support matrix, in order to maintain a uniform distribution of sand 5 and fibrous filler material throughout the support matrix.

Where substantially non-absorbent and/or non-water swellable filler material is used e.g. sand, certain polymer chips/beads (it will be appreciated that some types of polymer chips/beads 10 will be water absorbent and/or water swellable), it would generally be desirable also to include one or more other filler materials which are water absorbent and/or expandable (e.g. woodchips, sawdust, sphagnum moss), depending upon the desired playing properties required of the mat.

15

It will be appreciated that materials such as loam are available with a wide variety of properties and textures and for example may be peaty, fibrous or non-fibrous or clay-like. The abovementioned filler materials are not intended to be 20 exhaustive, but merely illustrative of the types of filler material which may be used in accordance with the present invention.

The filler material (within the mat) may be used in either a 25 wet or dry condition. It would generally be more convenient

to have the filler material in the dry state for transportation of the mats in order to minimise carriage costs and facilitate handling of the mats. Once installed, the filler material can have water added thereto if so desired.

5 Where it is desirable for the filler material in the mat to be in a wet/damp condition prior to installation it is desirable to use a support matrix which is resistant to the effects (such as rotting and tearing) of long term exposure to damp or humid conditions. The filler material and/or the material 10 from which the material are fabricated, can also be admixed or treated with one or more additives to prevent mould or fungus (or other similar conditions) growing thereon through exposure to water or damp conditions.

15 It will be appreciated that the packing material will generally have a certain moisture content sufficient to prevent excessive or unwanted settlement thereof when in an non-use condition. This moisture content will of course vary from material to material, and can readily be determined by 20 simple experimentation.

The filler material within the tubes is preferably dry when the mat is being stored in a non-use condition. In this way the mat is relatively light and easy to manoeuvre. Before 25 use, water can be added to the filler material. The water

generally causes the material to swell and/or become heavier and therefore becomes more tightly bound within the tubes and any supporting frame or container. The amount of water added to the mat in addition to the composition of the particular 5 playing surface filler material can be varied to suit whichever playing surface condition(s) is desired to be mimicked, thereby increasing the variety and number of conditions available to play or practice on.

10 Preferably or alternatively, there may be used a binder material (in combination of the abovementioned filler materials) which contains one or more additives which are capable of forming a semi-interpenetrating network (semi-IPN) or interpenetrating network (IPN) within the tube. The binder 15 material can be used to bind together one or more filler materials that have little or no interlocking ability as described previously herein.

The use of a binder material allows the use of materials which 20 would not normally be considered for use as such due to the lack of sufficient interlockability and/or being too dense and/or not being dense enough.

25 Binder materials are generally those which are not solvents for the filler material, and may be formed from one or a

mixture of polymerisable monomers and/or polymers. Suitable monomers and/or polymers are preferably those capable of forming polyolefins and may be thermoplastic or thermosetting. When polyfunctional monomers and/or polymers are used, then a 5 continuous cross-linked polymer system can be formed from the monomer and/or polymer. A semi-IPN is obtained when one of the co-continuous systems (i.e. the pre-existing polymer) is cross-linked. When both systems (i.e. the pre-existing polymer and the polymerised monomer) are cross-linked, an IPN 10 is formed. The formation of a semi-IPN/IPN within the tube also provides additional structural stability to the mat as a whole, in addition to helping to retain other filler materials in the tube.

15 The additive which forms the semi-IPN/IPN may be one, or a mixture or more than one, type of monomer which is polymerisable to form said semi-IPN/IPN. The polymerisation of the monomer(s) is preferably effected within the tubes prior to use of the mat. The polymerisation is preferably 20 ionic, most preferably cationic.

Desirably urea and formaldehyde are co-monomers, which are polymerised to form a co-polymer. The urea and formaldehyde are co-polymerised by the addition of an acidic catalyst 25 solution to the monomers.

Alternatively or desirably, papier maché may be mixed with binder or filler material and the papier maché, when set, provides further structural stability to the mat in addition to altering the mat playing characteristics.

The amount of papier maché and/or the amount of binder can be varied to achieve the desired balance of structural support and playing characteristics. This can be done as a matter of 10 simple experimentation to achieve the desired results. For example, in packing material comprising papier mache and peaty loam, to increase the structural support provided by the packing material it is desirable to increase the proportion of papier mache relative to the peaty loam. To increase the 15 resilience of the packing material it is desirable to increase the proportion of peaty loam relative to the papier mache.

Preferably, the filler material and the mat are derived from a material(s) which is (are) biodegradable or have previously 20 been biodegraded and/or may be recycled for re-use as a filling material or other component of the present invention.

Conveniently, the mat is provided with an outer casing generally in the form of an open-top container with a base and 25 sides inside which is more or less tightly packed said

assembly of tubes packed with filler material. The container may be fabricated from plastic, metal, wood, cardboard or any combination of the foregoing. The base and/or sides may be provided with one or more holes to aid drainage therefrom.

5

The outer casing helps to maintain the structural integrity of the close packed tube assembly in use and during handling and facilities transport and/or storage of the mats. Preferably, the sides of the container are no deeper than the height of 10 the tubes of the surface playing material. Conveniently, the length of the sides of the container is somewhat less than the height of the tubes, e.g. 10 to 50% less.

The upper surface of the mat of the present invention can be 15 played off with or without placement of a golf tee. With a mat of the present invention, a golf tee can be placed anywhere on the upper surface by pushing the tee into the filler material within the honeycomb form support matrix. Where the support matrix is in the form of upright tubes or 20 the like, then the tee may also be inserted between adjacent tubes or into the filler material within the tubes as described.

Where the honeycomb form support matrix is a more or less 25 integrally-formed structure this is conveniently formed from a

first series of substantially parallel horizontally extending panels which intersect and optionally interlock at a predetermined angle with a second series of substantially parallel horizontally extending panels to form a plurality of 5 interstices between the intersecting first and second series of panels. The angle at which the first and second series of panels intersect can be from 15° to 90° relative to each series of panels. The interstices are packed with filler material and/or binder material and for any one or more of the 10 previously mentioned materials or substances according to the present invention. It will be appreciated that the filler material used in this form of the present invention may be as described as above with reference to the tube assembly form of the support matrix.

15

In another aspect of the present invention there is provided a practice support platform comprising a raised platform with a flat upper surface provided with a player standing area and at least one playing surface area, said at least one playing 20 surface area is provided with one or more recesses formed and arranged for receiving a mat according to the present invention. Preferably, the mat is provided within an outer casing according to the present invention. This has the advantage that the outer casing with the mat therein can be 25 placed into and can be taken out of the recess in the practice

platform with the minimum of effort. This provides quick, clean and efficient method of changing the mat whenever required.

5 The player standing area is typically a rectangular area adjacent the at least one playing surface area. Where two playing surface areas provided, it preferable that the player standing area is located there between such that the upper surface of the platform is divided into three areas.

10

When the playing surface of the mat becomes too abraded through use, the mat can simply be replaced or alternatively turned upside down and play continued on the other side of the mat where both sides of the support matrix are open. Where 15 only very localised damage has been sustained it may be preferable to remove and replace only those tubes which have been damaged in the case of a tube assembly form support matrix. This can be done by simply cutting out the damaged tubes (if the tubes are bonded to adjacent tubes) and 20 inserting replacement tubes. Water may be added to the replacement tubes after they have been correctly positioned. Where water-swellable filler material is used this helps to ensure that the tubes expand and pack tight against the surrounding tubes and/or the outer casing where present.

In a yet further aspect of the present invention, where the mat becomes abraded or worn through use or otherwise, a top layer of the mat may be shaved off to present a fresh playing surface. Where an outer casing is used, this may 5 conveniently be provided with a vertically movable base portion which can be used to raise the mat to bring the new playing surface thereof up to or above the sides of the casing. The casing may be provided with a base displacement means such as a jack.

10

When it is desired to shave off the top layer of the mat the movable base is moved upwardly by the displacement means such that the top layer of the mat is raised and a suitable cutting means may be used to remove the top layer thus leaving a fresh 15 clean, flat and undamaged playing surface.

To fabricate the mats of the present invention with a tube-assembly form support matrix it is envisaged that there may be used machinery formed and arranged for filling essentially 20 continuous tubes with filler material, which continuous filled tubes are then cut into tubes of the desired length(s). The cut filled tubes can then be assembled together into a mat with a bonding step where the cut filled tubes are glued or otherwise attached to adjacent tubes and/or with packing of 25 the cut filled tubes into an outer casing or other container.

The mat of the present invention can also in a further embodiment contain one or more colouring agents such as a dyestuff and/or a pigment. Preferably, the mat is coloured green by use of the appropriate colouring agents.

5

Further embodiments of the present invention can be envisaged where the mat of the present invention can be used for other sports such as soccer, American football, rugby, tennis, athletics, hockey and the like where the playing 10 characteristics required of the mat differ according to the particular sport. For example in sports such as rugby and American football the mat requires to be robust enough to withstand the relative high pressures and shear forces applied to the pitches at the points of scrimmage. Whereas for soccer 15 pitches and athletics tracks, for example, the mat requires to be relatively more resilient in order that it does not, in use, become too difficult to run and play on.

It is also envisaged that the mat of the present invention can 20 be used to replace areas of heavy wear such as those which frequently occur around the goal-mouths of soccer pitches and the base-line service points on grass tennis courts.

It will be appreciated that it will generally be possible and 25 in many instances particularly desirable, to mix grass seed

with the packing material located at or near the upper surface of the mat of the present invention. The mat may then be stored in a suitably dry condition to prevent germination and growth of the grass seed until such times as it is desired to 5 grow the grass.

Additionally or alternatively, the grass seed may be grown by the adding water to the mat and allowing the grass to grow thereon. The growth of grass provides a more natural surface 10 appearance to the mat, and additionally, the grass roots provide additional structural integrity to the mat as a result of inter-locking of the root systems between grasses growing in neighbouring tubes.

15 Where grass seed is provided in the present invention, it would be desirable to include a suitable fertiliser to aid the growth and/or condition of the subsequently grown grass. For example, the fertiliser may be added as a solid or liquid to the packing material.

20

Further preferred features and advantages of the present invention will appear from the following detailed description given by way of example of some embodiments illustrated with reference to the accompanying drawings in which: -

Fig. 1 shows a container containing a mat according to one aspect of that present invention;

Fig. 2 shows a support platform according to another aspect of the present invention;

5 Fig. 3 shows a paper tube packed with filler material for use in forming a mat according to the present invention; and

Fig. 4 shows a close up plan view of the mat according to one aspect of the present invention and the possible locations for placement of a golf tee thereon.

10

A mat, as generally indicated by the reference numeral 1, according to the present invention is shown in Fig. 1. The mat 1 is constructed from a large number of close packed upright paper tubes 2, which are glued together along mutually 15 co-operating edges. The tubes are approximately 10 cm in height with a diameter of approximately 2.5 cm. The tubes 2 are packed with a filler material 4 (see Fig. 3).

The mat 1 is contained in a rectangular container 6 with sides 20 8 which are approximately 1 cm less in height than that of the tubes 2. The container 6 is approximately 25 cm in length and 15 cm in width and the mat 1 is of substantially the same dimensions such that it fits tightly within the container 6.

25 A raised (approximately 20 cm from the floor to an upper

surface) rectangular support platform 10 (see Fig. 2) is provided with a player support area 12 located between two recesses 14. The player support area 12 is rectangular (75 cm x 60 cm) and is provided with a plastic non-slip surface 5 coating.

The recesses 14 on opposing sides of the player support area are rectangular (25 cm x 75 cm) and are formed and arranged to receive a plurality of containers 12. The recesses 14 have a 10 number of locating holes 16 which are formed and for receiving corresponding projections 18 extending from each of the corners of the base of the containers 14 where the containers 14 are placed in the recesses 14 as shown in Fig. 2.

15 A single tube 2 according to the present invention is shown in Fig. 3. The tube 2 is filled with packing material 4 which is sphagnum moss 20 intimately mixed with wood chips 22.

A plan view of the mat 1 of the present invention indicating 20 the hexagonal close packaging arrangement is shown in Fig. 4. In the pulses hexagonal close packing arrangement each tube (or central tube) is typically surrounded by six other tubes forming a hexagon shape around the central tube. This is the case for every tube except those tubes 2 at the edge or corner 25 of the container 12.

Possible locations for placement of a golf tee (not shown) are indicated by the letters X Y and Z in Fig. 4, wherein : X is located on the top of a tube 2; Y is an interstice as defined by three neighbouring tubes in the hexagonal close packed formation; and Z is defined as the region between two neighbouring tubes. It will of course be appreciated that X, Y and Z are not intended to be limiting on the possible locations for placement of a golf tee and that the flexible nature of the mat 1 allows a golf tee to be placed substantially anywhere thereon.

#### **Example**

In one embodiment of the present invention, the tubes are formed from sheets of newspaper cut to the required size and 15 rolled then taped (with adhesive tape) into the form of a cylinder with a diameter of about 12 to 16 mm and a height of about 12 cm. The tubes were packed (by hand) with commercially available peat moss (the composition of which is given below). A number of the thus formed tubes were close 20 packed upright into an open top container with sides of length and breadth of 20 cm by 15 cm and a depth of 12 cm.

The composition of the packing material was determined as follows: The packing material (100 g) was heated in a domestic 25 oven at 40 °C for 12 hours after which time the weight of dry

material recovered was 47 g; which is equivalent to the packing material comprising 53 wt% water and 47 wt% dry material.

5 The recovered dry material (47 g) was then roasted in air on an open metal plate heated by a Bunsen burner for approximately 45 minutes to remove the organic matter thereof. The material recovered after roasting weighed 18 g, and was designated as being mainly inorganic material. The dry 10 material was therefore determined to comprise: 62 wt% organic material and 38 wt% inorganic material.

The density of the uncompressed packing material as originally obtained commercially was determined by placing 100 g of the 15 packing material into a volumetric measuring cylinder which was firmly tapped around its outer surfaces to ensure the packing material was properly settled in the measuring cylinder. The volume occupied by the packing material was read off from the measuring cylinder. The density was simply 20 calculated thereafter as grams of material per  $\text{cm}^3$  occupied by the material.

The density of packing material before drying was  $0.52 \text{ gcm}^{-3}$  (100  $\text{cm}^3$  packing material has a volume of  $192 \text{ cm}^3$ ); the density 25 of the dried (at 40 °C) packing material was  $0.625 \text{ gcm}^{-3}$  (100 g

dried material had a volume of 160 cm<sup>3</sup>); the density of the inorganic (roasted) material is 2.50 g cm<sup>-3</sup> (100 g of the roasted material had a volume of 40 cm<sup>3</sup>).

5 The large volume of dried material is due mainly to the presence of relatively large particles of soil with correspondingly large air spaces therebetween. The dry material (and the moist packing material) had relatively large air spaces between the material particles, which in turn is 10 representative of a well aerated soil, which is particularly suited to use as a golf teeing off surface due to the inherent resilience provided by the material.

The particle size of the dry material was determined by 15 passing a known weight of the dry material through a series of sieves with known mesh sizes. The particle size distribution (as wt%) of the dry material was:

9-2 mm = 47 wt%; 2-1 mm = 21 wt%; ≥ 5 mm = 6.0 wt%; < 5 mm = 26 wt%.

20

Various modifications may be made to the above described embodiments without departing from the scope of the present invention.

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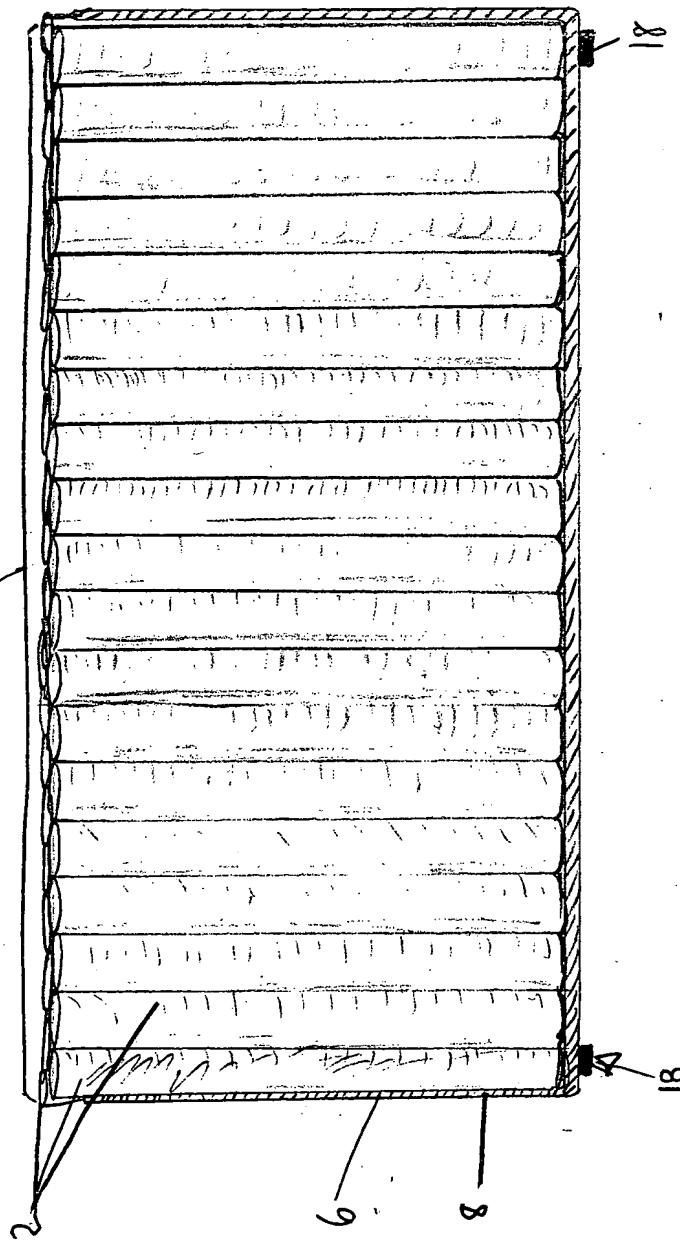


Fig. 1

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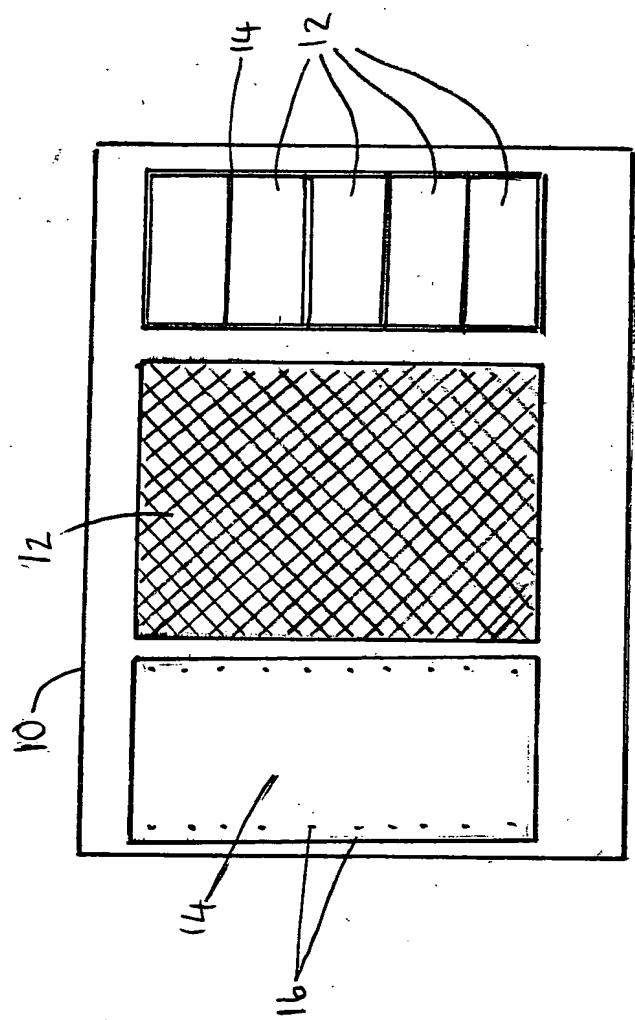


Fig. 2.

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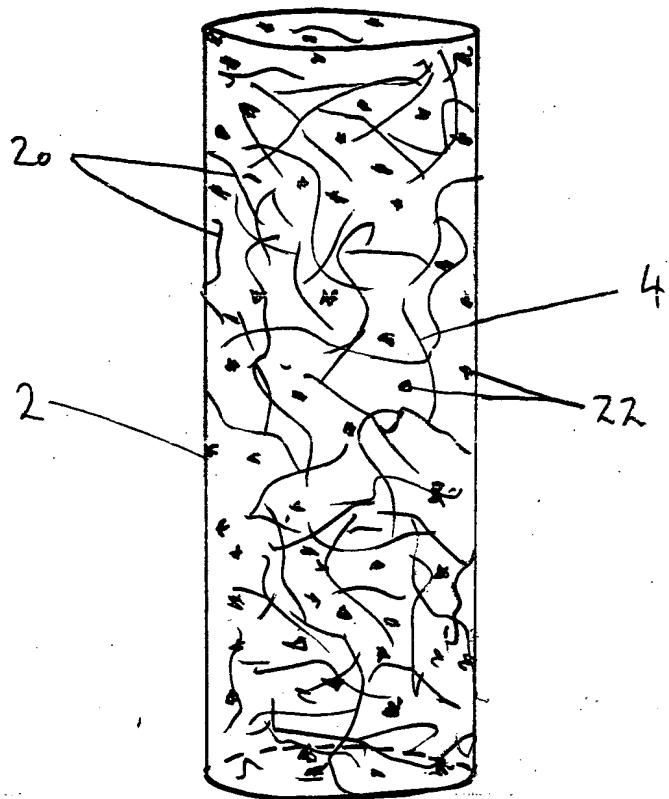


Fig. 3.

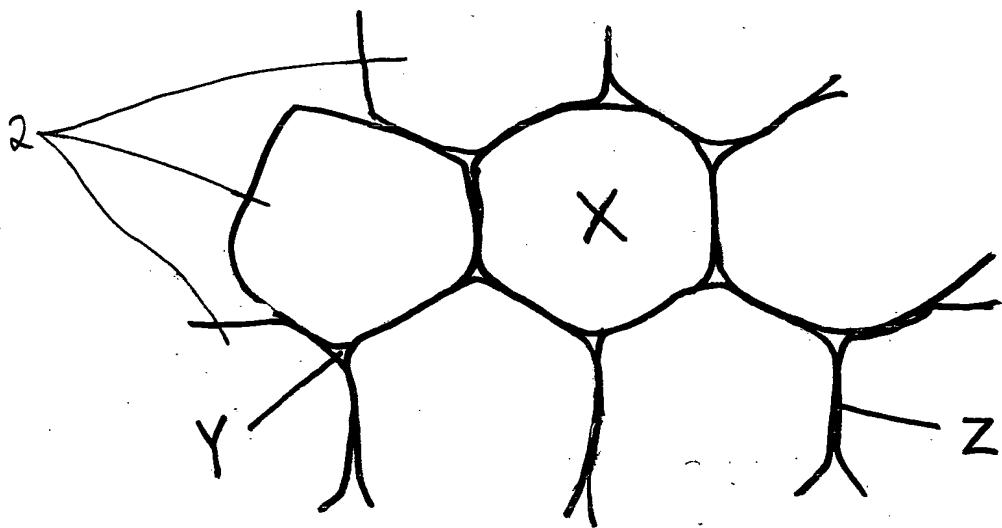


Fig. 4

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